Real-time Integration of Biological, Optical and Physical Oceanographic Data from Multiple Vessels and Nearshore Sites using a Wireless Network

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LONG-TERM GOALS

Our long-term goal is to quantify the interactions between small-scale biological and physical processes within the upper ocean. This project addresses that goal by providing the technical infrastructure to allow collaborating investigators on separate vessels to share data and conduct adaptive sampling using wireless networking.

OBJECTIVES

Our objective is to link the data streams from nearby vessels and shore stations into a coherent wireless network which permits collaborating investigators to share, analyze, and discuss field data as data collection is in progress.

APPROACH

We have selected commercially available wireless communications instrumentation to connect two oceanographic research vessels and two shore stations, all of which will be within a five mile radius during upcoming field experiments in Puget Sound. Each research vessel will use multi-sensor profiling instrument packages which obtain high-resolution physical, optical and biological measurements of the upper ocean. Each shore station will monitor data acquisition from instrumented moorings and meteorological instruments. The data from the profilers on the separate vessels and from the moored instruments will be accessible to participating investigators via wireless bridges connected to the local networks on each vessel and at each shore site. In addition, the ship/shore network will be linked via another wireless bridge to a nearby T1 connection to the Internet.

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WORK COMPLETED

We have begun the evaluation of different wireless communication systems. Our preliminary evaluations show that commercially available wireless systems can provide

2Mbps data rate
direct sequence spread spectrum which is secure and requires no additional FCC license
up to 10-15 mile range with directional antenna
2-3 mile range over water with omni-directional antenna
SNMP support
multipoint media access control protocol to eliminate packet collisions
easy installation.

RESULTS

No scientific results to report at this preliminary stage of equipment evaluation. The field deployment of the wireless network is planned for May-July, 1998, at Orcas Island, WA.

IMPACT

We expect that wireless communication systems will permit rapid, on-site, collaborative evaluation of separate data sets collected by investigators on different vessels. The networked data sets from separate vessels and shore stations will provide investigators with the unique opportunity to evaluate biological, optical and physical oceanographic data in real time, and to develop timely responses to changing conditions.

TRANSITIONS

This project may help with the transition from discrete, separate field experiments/data collection efforts to a linked, networked activity which provides remote data sharing and data interaction between scientists at nearby locations. It can enhance our ability to focus our sampling efforts over short time scales and rapidly adapt to changing environmental conditions. In addition, the linked data on a wireless network at a remote site can be connected to the Internet backbone so that investigators at home institutions can participate in the real-time data process. This remote wireless research network provides a model for future deployment of complex field operations which require high-speed, high-capacity networks which can be implemented in a few hours or less, provide secure transmission of data within the local network, and provide connection to the larger Internet. We see the application of this wireless network instrumentation in the ongoing East Sound project to be a first step toward continental shelf and open ocean deployments with the next generation of wireless and satellite communication technologies.

RELATED PROJECTS

This DURIP proposal is tightly linked to the field efforts of the following ONR Principal Investigators:

Dr. Percy Donaghay, University of Rhode Island
Dr. Jan Rines, University of Rhode Island
Dr. Dian Gifford, University of Rhode Island
Dr. Alice Alldredge, UC Santa Barbara
Dr. Sally MacIntyre, UC Santa Barbara
Dr. Van Holliday, Tracor Systems